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metric measures

JOURNAL OF WEIGHTS AND MEASURES

THE PUBLICATIONS DIVISION

40 PAISE

ABBREVIATION FOR METRIC UNITS

(1) DECIMAL MULTIPLES AND SUB-MULTIPLES

Prefix		Value in Terms of Unit	Abbreviation
Kilo	..	1,000	k
centi	..	0·01(10^{-2})	c
milli	..	0·001(10^{-3})	m
micro	..	0·000 001(10^{-6})	u

(2) WEIGHTS

Denomination		Value	Abbreviation
tonne	..	1,000 kg	t
quintal	..	100 kg	q
kilogram	..	1 kg	kg
gram	.	1 g	g
milligram	..	1 mg	mg
carat		200 mg	c
(3) CAPACITY			
kilolitre	..	1 000 l	kl
litre	..	1 l	l
millilitre	..	1 ml	ml
(4) VOLUME			
cubic metre	..	m^3	m^3 or cu m*
cubic centimetre	.	cm^3	cm^3 or cu cm*
cubic millimetre	.	mm^3	mm^3 or cu mm*
(5) LENGTH			
kilometre	..	1 000 m	km
metre	..	1 m	m
centimetre	..	1 cm	cm
millimetre	..	1 mm	mm
micron	.	1/1 000 mm or 10^{-3} mm	um
(6) AREA			
square kilometre		1 000 000 m^2	km^2 or sq km*
square metre	..	1 m2	m^2 or sq m*
square centimetre		1 cm^2	cm^2 or sq cm*
square millimetre		1 mm^2	mm^2 or sq mm*
(7) LAND MEASURE			
are	..	100 m^2	a
hectare	..	100 a	ha
centiare	..	m^2	ca

*Both these abbreviations are current, but the first set should preferably be used. The former abbreviation is used more commonly internationally than the latter.

Rules for Abbreviations :

(1) Do not make any change, such as addition of 's' to indicate plurality *e.g.*, write 1 kg, 10 kg, 20 g, 5 g, 10 t, 20 ml, 271, 165 km, 2 mm, 100 cm^3, 66 km^2.

(2) Do not capitalize the abbreviations. For example, do not write 1 Kg, 2 Kg, 20 MM, 50 MM; the right way is to write 1 kg, 2 kg, 20 mm, 50 mm, etc.

(3) Do not use any other abbreviations except those given above.

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Development of Length and Area Measures In South India—Part 5

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New Delhi

WE have considered in the first four Parts the development of length and area measures in India from ancient times, derived a theory on the basis that the 28 angula hasta of *Arthasastra* measured exactly 50 cm, and applied the theory to the length and area measures available in South Indian temples, historical and other records or tradition.

In this fifth and concluding Part, we shall consider the application of the theory to the length and particularly the area measures in the States of Andhra Pradesh, Mysore and Kerala.

ANDHRA PRADESH

Ganjam

In Ganjam district the length of the mura is said to be estimated at 19·5 in (49·53 cm). This is equal to $3 \cdot 811 \times 13 = 49 \cdot 54$ cm, *i.e.* it is equal to 13 angula. It is also 1/10 of the kol for irrigated garden lands, and ¼ of the bauham of 1·982 m discussed under Madura. On this basis, the 8 cubit rod, which was assigned a length of 13 ft (3·962m) works out to be 3·963 m. It is on the basis of the cubit or mura of 49·54 cm that we shall evaluate the area units in this district.

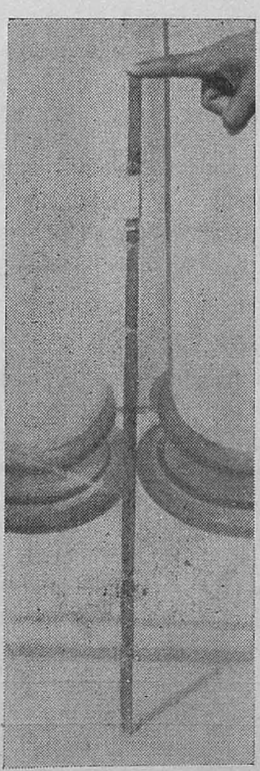

Fig. 1—The tutcha-kol was a popular length measure in South India. It measured 33 inches or 83·82 cm. Shown above is a sample recently obtained from the Tirunelveli area.

One of the commonly used equations is :

1 rod square	= kunta	=	15·71m²
50 kunta	= 1 bharnam of irrigated land	=	785·4 m²
100 kunta	= 1 bharnam of unirrigated land	=	1570·9 m²
600 kunta	= 1 garce	=	9425 m²

A garce was equal to 80 kunta = 9680m² or 2·347 acres. This compares favourably with the garce calculated above.

Godavari

In Godavari district the cubit was about 19·8 in *i.e.* 50·29cm.

A commonly used table was[59] :

			As Given	As Calculated	
				I	II
manadi		2½ cents	= 101·2 m²	100 m²	101·25 m²
2 manadi	= 1 addedu	5 cents	= 202·4 m²	200 m²	202·5 m²
2½addedu	= 1 kunchedu	10 cents	= 404·7 m²	400 m²	405 m²
10 kunchedu	= 1 iddamu	1 acre	= 4046·9 m²	4000 m²	4050 m²
2 iddamu	= 1 yedumu	2 acre	= 8093·7 m²	8000 m²	8100 m²
2 yedumu	= 1 penduhumu	4 acres	=16187·4 m²	16000 m²	16200 m²
2 penduhumu	= 1 putti	8 acres	=32374·9 m²	32000 m²	32400 m²

The values recorded for these units are bharnam (1571m²) = 0·39 acre or 1578m² and garce = 2·33 acre or 9429m². The values given above agree.

The correctness of our assumptions is further confirmed by the fact that the 'wet' bharnam, by measure, was taken to be 8 kunta *i.e.* 8/40 of an acre and dry as 16/40 of an acre.

Odd lengths of rods like 7-½ cubits (3·716m) were also used. A rod of about 16 mura and 16 angula, equal to 27 ft (8·230m) was also used. This rod would be 8·257m, the mura being 49·54cm. Then 25 square rods = 1 mauna = 1704m².

An interesting rope of 22 cubits equal to 36 ft was used in this area. This works out to 11m (36·089ft.) if mura is 50cm the kunta being a square rope *i.e.* 121m².

Obviously, there is a certain amount of rounding off to make the iddamu equal to exactly 1 acre if putti is taken as equal to 32,000m².

Another point of view of looking at these tables would be to equate the putti with the 32400m² paridesa (*see* Table 5, Part 2) and from that derive the rest of the smaller units. In this case the cubit is 50·31cm (16 rods = $\sqrt{1620}$ = 40·249m and the cubit would be 50·311cm). This cubit reminds us of Gudea's cubit (*see* Part 1). The values based on a cubit of 50cm and 50·31 cm are presented as I and II in the above table. Similar results are also presented for other tables later on.

There was in use another table which corroborates the above table. It is :

	As Given		As Calculated	
			I	II
5 cubits=1 rod or veesam	—	—	2·5m	2·516m
16 rods (80 cubits) = 1 puggum.. ..	132 t.	40·234m	40m	40·249m
1 sq. puggum = 1 kunta	0·4 acre	1618·8 m²	1600 m²	1620 m²
20 kunta = 1 putti (80 kuncham) ..	8 acres	32375 m²	32000 m²	32400 m²

There were other putti measures in use :

kunta was 88 cubits (44m) a side, (1936m^2), 20 kunta giving a putti of 38720m^2 and,

	As Given		As Calculated I	As Calculated II
32 cubits=1 puggum	—	—	16 m	16·1 m
1 sq. puggum=1 kunta	2787·84 ft.	259 m^2	256 m^2	259·2 m^2
100 kunta=1 putti	6·4 acres	25900 m^2	25600 m^2	25919 m^2

The putti under I is twice the goru examined in Part 3. The values under II are derived for comparison.

Another putti used in the islands in the Godavari river was :

35 kunta giving a putti of 67760m^2. A kutti of 32 kunta, each kunta being a square of 96 cubits was also used. ($48 \times 48 = 2304m^2 = 2304 \times 32 = 73728m^2$). A still larger unit had 98 cubits (49m) to the side; 20 such kunta, each of 2401m^2, making

	As Given		As Calculated I	As Calculated II
6 cubits = 1 rod or veesam	—	—	3 m	3·019 m
16 rods (96 cubits) = 1 puggum... ..	—	—	48 m	48·3 m
1 sq. puggum = 1 kunta	25090 ft^2	2331 m^2	2304 m^2	2333 m^2
20 kunta = 1 putti	11·52 acres	46500 m^2	46080 m^2	46658 m^2

Still another measure was used near Masulipattam :

48020m^2.

	As Given		As Calculated I	As Calculated II
80 cubits=1 puggum	—	—	40 m	40·25 m
1 sq. puggum = 1 kunta	—	—	1600 m^2	1620 m^2
32 kunta = 1 kutti	12·8 acres	51800 m^2	51200 m^2	51840 m^2

The calculated kutti in (I) is $\frac{1}{2}$ of the kuchchala examined in Part 3.

Most of the above calculated kunta are supported by ancient literature, though the number of multiples taken for forming the higher units is not. The values derived from a cubit of 50 cm appear to be more acceptable in some cases than those based on the cubit of 50·31 cm.

An 84 cubit (42m) kunta (1764m^2) was also used : 32 kunta gave a kutti of 56448m^2 and 20 kunta another of 35280m^2. Another

Another measure mentioned is :

40 cubits	= 1 rope	= 20 m
1 sq rope	= kunta	= 400 m^2
100 kunta	= 10 acres (4 ha)	

Most of these measures can be supported in ancient tradition, on the 50 cm cubit. The cubit could also be taken as 50·31.

Krishna

Krishna district is full of a variety of area measures. The land measure best

known is the kuchchala, generally subdivided into 64 kunta, but sometimes into 32, and even 100, 30 and 40.

The kunta is normally a square each side of which measures 80 cubits (40m) but the number of cubits may vary. The cubit is usually $\frac{1}{4}$ of a fathom, and the fathom is said to be 78·8 inches, giving a cubit of 19·7 inches or say 50cm. The following are some of the measures :

Sl. No.	Rope in cubits	Kunta		Kuchchala (64 kunta)	
		m²	Acre	Hectares	Acres
(1)	80(40m)	1600	0·396	10·24	25·30
(2)	76(38m)	1444	0·357	9·24	22·87
(3)	74(37m)	1369	0·339	8·76	21·68
(4)	72(36m)	1296	0·321	8·29	20·53
(5)	66(33m)	1089	0·269	6·97	17·25
(6)	64(32m)	1024	0·253	6·55	16·22

Of these (1) and (4) were most commonly used. They are also supported by ancient tradition, as also (6). No. (5) is in line with the 22 cubit tradition explained earlier under Ganjam district. No. (2) and No. (3) cannot be explained by any tradition. The kuchchala may also contain 32 or 100 kunta.

There is another cubit on which kunta may be based. Here 5-$\frac{1}{2}$ cubits make 9-$\frac{1}{2}$ ft (2·896m) *i.e.* cubit is 20·7 in (52·6cm) I

Two others are :

4$\frac{1}{2}$ cubits = 7 ft 8 in (2·337 m)
∴ cubit = 20·44 in (51·92cm) (Garden land cubit) II
4$\frac{3}{4}$ cubits = 8 ft 2 in (2·489 m)
∴ cubit = 20·62 inches (52·37 cm) (Bezwada cubit) III

Areas are expressed as kutti, which normally contains 32 kunta, but occasionally 35 or 20 kunta.

The following table lists the values as given and as calculated from old traditions.

	As Given		As Calculated		
(1) 88 cubits (I)	152 ft.	46·330 m	1·9286×24	=	46·286 m
kunta	0·53 acre	2144·8 m²			2142·4 m²
kutti					
=20 kunta	10·61 acres	42937 m²			42948 m²
=32 kunta	16·97 acres	68675 m²			68557 m²
=35 kunta	18·56 acres	75110 m²			74984 m²
(2) 80 cubits (I)	138·2 ft	42·123 m			42·078 m
kunta	0·44 acre	1781 m²			1770·6 m²
kutti					
=20 kunta	8·77 acres	35491 m²			35411 m²
=32 kunta	14·02 acres	56737 m²			56658 m²
=35 kunta	15·34 acres	62079 m²			61970 m²
(3) 72 cubits (II)	122·7 ft.	37·396 m	26·68cm×140=		37·352 m
kunta	0·35 acres	1398·5 m²			1395·2 m²
kutti					
=32 kunta	11·05 acre	44718 m²			44646 m²
=35 kunta	12·09 acres	48927 m²			48831 m²

	As given		As calculated
(4) 76 cubits (III)	130·6 ft.	39·807 m	28·46cm×140= 39·844 m
kunta	0·39 acre	1578 m^2	1588 m^2
kutti=32 kunta	12·54 acres	50748m^2	50801 m^2

From the values recorded under (1) above, it will be obvious that the calculated kutti of 20 kunta is exactly equal to 2 nivartana or mattar (21424·308m^2) derived in Part 3, *i.e.* 10 of this kunta make a mattar. The above kunta is also 10 times the kunta derived in Part 3 (214·24308m^2 × 10). The other two kutti measures are mere multiples of the kunta.

The division of the rod into 88 parts or cubits also gives rise to a new cubit *viz.* 52·60 cm (46·286 ÷ 88), which can then be taken 80 times to give another unit for area measures *i.e.* 42·078m. The difference between the given and calculated values is 46·330-46·286 m = 44mm, which is 1 : 1000 which is within the limits of error for the best surveying chains even today.

The second value of the rod *viz.* 37·396 m is not easily derived from any measure unless we make the assumption that it is made up of 140 adi of 26·68cm each *i.e.* 37·352m, a difference of 4cm, which is not large, if we remember that the value of adi is derived from the paurusha of 108 angula mentioned in the *Arthasastra.* The cubit is then 51·88 cm (37·352 ÷ 72).

The third value of the rod *viz.* 39·807m is also derived from another adi = 28·46 × 140 = 39·844m, which is 4cm larger than that given in literature. The cubit is then 52·42cm.

Nellore

In Nellore district, a rod of 32 cubits which was found to measure 52½ ft (16·002m) was used for measuring garden lands. This gives a cubit or mulam of 19·68 in (50 cm).

The usual table is :

	As Given	As Calculated
1 rod sq.= 1 kunta	2756¼ ft^2 256·06 m^2	256m^2
50 kunta= 1 gurtu	3·1637 acres 12803 m^2	12800m^2

Garden or jareeb lands were measured with a rod of 21 cubits or 34-29/64 ft (10·50m), but the resulting gurtu is the same :

	As Given	As Calculated
1 rod sq. = 1 kunta	1187 ft^2 110·28 m^2	110·25m^2
116 kunta = 1 gurtu	3·161 acres 12792 m^2	12789 m^2

In some parts 8 gurtu made one kuchchala of about 25 acres (10·1150 ha). These old measures have already been explained in Part 3, the kuchchala having a caculated value of 10·24 ha.

Vishakhapatnam

In certain parts of this district the following table was used :

	As Given	As Calculated
1 kol	9·4 ft 2·864 m	2·859 m
(kol)^2 = 1 kuncham	88 3/8 ft^2 8·21 m^2	8·17 m^2
20 kuncham =1candy =1 putti	1768 ft^2 164·3 m^2	163·5 m^2
30 candy =1 garce	1·21738 acres 4927 m^2	4904 m^2

In other parts the following table is used :

	As Given	As Calculated
kol	57·57 ft 17·547m	17·508 m
(kol)^2 = para	3315 ft^2 308·0m^2	306·2m^2
16 para =1 veesam =1 garce	1·21738 acres 4927 m^2	4904 m^2
16 veesam=1 kathi	19·4782 acres 78826 m^2	78469 m^2

The kol in the first equation can be equated with 75 angulam derived in Part 3 (75$\times$ 3·811cm=2·859m). Alternatively, it could be 5 kisku of 32 angula (0·5714$\times$5=2·857m) of *Arthasastra.* In the second case, it appears that the value of garce was taken as 4927m^2 and the subunits derived from it by dividing it into 16 parts to get the para and so on. Our calculated values are submutiples of 4904m^2 derived in the first equation.

KERALA STATE

Trivandrum

	As Given		As Calculated
1 angulam=	1¼ in	3·175 cm	3·176 cm
24 angulam =1 kol	30 in	76·20 cm	76·23 cm
4 kol=1 dandu	10 ft	3·048 m	3·049 m
1 sq. dandu=	100 ft^2	9·289 m^2	9·296 m^2
434 3/5 sq dandu=acre	43560 ft^2	4037 m^2	4040 m^2

It is obvious that the kol is just equal to 20 angulam, each of 3·812 cm, which was derived in Part 3. Jervis[60] has pointed out that a 'guz' of '20 tasoos' is used in Malabar, Canara and Dravid. It cannot be doubted that he is referring to this 'guz' of 76·23cm. This kol was then divided into 24 angulam of new imension. The dandu happens to be equal to 80 angulam.

The calculated acre of 4040m^2 should be looked upon as related with 4050m^2 *i.e.* ½ the nivartana of 8100m^2. (*see* Table 5 in Part 2).

Trichur

In Trichur district the following table was used :

	As Given		As Calculated
8 barley corns =1 angulam= 1 viral	1-1/6 in	29·63 mm	29·65 mm
24 angulam= 1 carpenter's kol	28 in	71·12 cm	71·15 cm
4 kol=1 dandu	9-1/3 ft	2·845 m	2·846 m
1 sq. dandu = 1 perukkam	9·649 yd^2	8·068 m^2	8·10 m^2
40 perukkam= 1 para	385·96 yd^2	322·7 m^2	324 m^2
500 perukkam= =acre	4825 yd^2	4034 m^2	4050 m^2

If we assume that 500 perukkam are equal to 4050m^2, *i.e.* half of nivartana of 8100m^2 (*see* Table 5, Part 2), then the perukkam acquires a value of 8·10m^2. Taking the square root, the length of the dandu works out to 2·846 metres. This dandu is divided into 4 kol and the kol is further divided into angulam etc. Curiously enough, the Trivandrum table starts by defining the kol and arriving at the value of the half nivartana. While the Trichur table starts with the final unit of half nivartana and subdivides it to obtain the smaller units.

MYSORE

In the Mysore area, the khanduga and its subdivisions were used. We have considered these in detail in Part 3. A unit called kollaga was also used and is mentioned in inscriptions but no value of its estimate is available; 12 or 20 of it are supposed to make a khanduga.

Estimated Units

There are certain units of land area which are estimates and they vary depending on type of land, grain and so on. Even well-defined units are expressed as estimates. For example, the *Manual*[41] informs us that in North Arcot, the kani was supposed to be the land (irrigated) which required 63 Madras measures or 75 local measures to sow it. For unirrigated land, the kani was the area requiring $15\frac{3}{4}$ Madras measures or $18\frac{1}{4}$ local measures to sow it, the kani being unaltered in area. Another estimated area unit is the moody, in South Kanara, which was supposed to be the area requiring 60 seers (of 80 tola weight of rice) to sow it. The moody could also be 56, 50, 48, 45, 40 or 35 seers.

Our analysis so far would show that such estimated area measures had perhaps a basis in old traditions of area measures but it was lost sight of in the mind of the general public in the course of time.

Conclusion

On the basis of the argument in this article, we can now conclude that for the ordinary transactions involving length measures, a scale measuring 50cm was generally in use in the whole of South India; side by side, length measures derived for use in measuring land areas were also used for certain specialized purposes. The tradition of the use of the 50cm measure appears to have had a continuity spread over a few millenia.

So far as measurement of land areas is concerned the roots of the various practices go back to the *Arthasastra* and even earlier times. The twists and turns through which the principal area units passed, led to a variety of units which became difficult to understand as years and centuries passed. The tendency to adapt the few units to serve a large variety of interests led to an apparent confusion which is without parallel.

An immediate lesson for India is that it is highly undesirable to adapt the units of an otherwise well-ordered system of weights and measures to overcome some temporary difficulty or to serve as a prestige issue. The metric system, which can be regarded to a certain extent as a beautifully refined version of the ancient Indian tradition in metrology, has now been adopted in our country. We should not vitiate its simplicity, uniformity and the gradation of its units by abusing the various units to suit our temporary conveniences. The history of metrology in India serves as a stern warning to people who indulge in such activities.

This article, concluded with this Part, touches only the fringe of the vast field of Indian metrology. It is not possible to explain each and every variant of units of weights and measures. An attempt has, however, been made to search out the roots of Indian metrology and the subsequent developments of the metrological traditions in South India.

It is intended to analyse the length and and area measures in Western, Northern and Eastern India in subsequent series of articles.

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Prototype Approval Centre for India

IN countries where the manufacture and use of weighing and measuring instruments are in an advanced stage of development, control is exercised by the Central Authority on the design and construction of weights, measures and instruments which are used in trade transactions. Instances are the United States, Canada, U.K., France, Belgium and other countries in Western and Eastern Europe. Before designing a new product, or making any change in the design of an existing product, the manufacturer sends particulars of the design, complete with drawings, to a Central Authority. He also sends a prototype. These are examined by the central authority, which subjects the prototype to rigorous tests laid down for the purpose. If the Authority is satisfied that weights measures and instruments manufactured according to the design would be suitable for use in trade, it issues an approval certificate. An Inspector of Weights and Measures would not accept a weight, measure or instrument which does not conform to an approved prototype.

Procedure in France

In France, all new designs as well as changes to existing designs are subject to approval by a Central Organisation. The manufacturer furnishes the Organisation full particulars of the design, material, and performance of the instruments. In cases where only minor changes in existing designs are proposed, approval is given after examining the drawings and studying the descriptive data. In cases of major changes in vital parts, and in all cases of new designs, a rapporteur of the Central Organiation visits the manufacturing establishment and tests patterns. Before giving final approval, he may also study the performance of the instrument under actual working conditions.

Practice in the U.K.

In the U.K. examination of prototypes has been in vogue since 1904. Recently the U.K. Weights and Measures Act, 1963, broadened the scope of this examination. Under the new Act, the equipment made according to the design should be of good quality, design, and in every case, 'suitable for use for trade'. The Board would have to examine its suitability having regard 'to the principles, materials, and methods used in construction.'

The approval of a pattern may be limited to a specified period. The Board may revoke a certificate once granted. They may lay down *specifications for the guidance of* examiners.

The manufacturer ordinarily sends a pattern for approval after conducting elaborate experiments in his workshop. The final experimental model is sent to the Board of Trade with a descriptive note and a general arrangement drawing, outlining constructional features. The Board examines the design and tests the model. They may dismantle the machine to satisfy themselves that the design features are acceptable and in conformity with specifications. The Board may

carry out weighing tests to check whether the machine is so designed that it can be verified by Inspectors without difficulty. If the Board's examination brings any undesirable features to light, the manufacturer's attention is drawn to them.

Adoption of the System in India

In India regulation of weights, measures and instruments is limited to their verification by Inspectors of Weights and Measures. There is no control at the stage of the prototype. The institution of a system of examination and approval of prototypes would be of benefit to manufacturers and users as well as to the enforcement staff. It would promote the manufacture of weights, measures and weighing and measuring instruments of high quality and reliability. Verification by Inspectors guarantees accuracy at the time of verification, but not of continued reliable service. The approval of the prototype before manufacture by a Central Authority would correct this defect and also eliminate all disputes between manufacturers and Inspectors regarding design features.

It was against this background that the 7th Conference of Controllers held in Delhi in August 1963 recommended that a Prototype Approval Centre may be set up in India. A Committee consisting of representatives of the Directorate of Weights and Measures, Controllers of Weights and Measures of States, the Mint, Bombay, National Physical Laboratory, Indian Standards Institution, the Directorate-General of Technical Development, and certain manufacturers of weighing and measuring instruments was set up.

This Committee met on 4 August 1964 at Calcutta and recommended the following :

(1) NPL Offer to Set Up Centre

It was unanimously agreed that a Central Authority for approving prototypes before regular production was a necessity. In view of the facilities available with them the NPL offered to take up the testing work.

(2) Specifications

The specifications drawn up by the ISI for weights etc. did not provide for type testing in every case. For this purpose more comprehensive specifications specifying tests for raw materials, components and performance of assemblies have to be drawn up. It was, therefore, agreed that ISI should prepare proposals for drawing up specifications to enable type approval of the simpler instruments to be taken up in the near future.

(3) Coverage of the Scheme

The present ISI specifications for weights, and capacity measures give details of design. Type approval of these items would be made voluntary in the beginning. For length measures, weighing and measuring instruments it should be made compulsory by law to submit new designs for type testing to the Central Authority. Existing designs would have to be submitted for approval within a phased but specified period.

(4) Legislation

Necessary changes would be made in the Weights and Measures (Enforcement) Acts of the States to recognise that only such weights etc. would be accepted for verification as have been approved after type testing by the Central Authority.

(5) Fees

Fees would be levied for type approval. The basis for charging fees would be decided later.

Metric System in Cadastral Survey

The Second All India Cadastral Surveys Conference 1964 was held at Mussoorie on 22 and 23 June 1964, under the Chairmanship of Brigadier Gambhir Singh, Surveyor General of India. The Conference was attended by officials of the Survey of India, Directorate of Weights & Measures, Ministry of Commerce, and representatives of the State Governments.

Among the points discussed was one relating to conversion to metric system in cadastral survey work. After reviewing the work done in implementing the programme drawn up at the last Conference in 1957* and noting the progress achieved in many States and Union Territories, the Conference resolved to adopt the following programme for the future :

(1) On a number of cadastral survey maps in many States metric scales and conversion charts have been incorporated. The work will be completed in all States and Union Territories as early as possible and not later than 1-1-66. In States where there are separate field books which give the measurements of all the plots or where separate conversion scales have been supplied, the drawing of these scales may be dispensed with.

(2) When fresh land records are prepared during resettlement operations or when existing records are rewritten, areas will be expressed in metric system *i.e.* in hectares, ares and centiares. Areas in old units may also be retained, where necessary.

(3) During new and revision surveys, maps will be redrawn on metric scales. Existing maps will be brought on to metric scales by photographic reduction for the purpose. In States where no revision surveys are planned in the near future (say within next five years) the existing maps will be converted to metric scales, gradually according to convenience, so that maps on metric scales may become available when resurvey is due.

*See *Metric Measures*, Jan. 1958, p 26.

Second Meeting on Change-over to Metric System in Building Industry

The first Conference for the adoption of the metric system in building, architecture and town planning was convened by the Ministry of Works & Housing in New Delhi on 2 and 3 September 1959. The Conference had passed a number of resolutions and framed a three-phased programme for the implementation of the metric system in building industry.

As nearly five years have since passed, the time was now ripe to convene a business meeting to review the progress made so far, to discuss the difficulties experienced in the change-over and to formulate future programme of action. The second meeting is proposed to be held by the National Buildings

Organisation, New Delhi, some time in October 1964.

Engineers from various Public Works authorities, public sector undertakings, municipal corporations and representatives of architects, contractors and town planners would attend this meeting.

It is proposed to hold at the time of the meeting an exhibition of metric building products, survey and drawing equipments and codes and certain other publications which are available in metric units.

Clinical Thermometers

The Indian Standard Specification for Clinical Thermometers was finalised and approved for printing at the Fourth Meeting of the Laboratory Glassware and Related Apparatus Sectional Committee (CDC 33) of the Indian Standards Institution of 29 June 1964. Earlier on 25 and 26 June the Thermometer Subcommittee (CDC 33:2) considered the comments on the draft standard as a result of wide circulation.

There was considerable discussion whether the Fahrenheit scale should also be provided on the stem of the thermometer. In view of the fact that the metric change-over in industries has to be completed by April 1966 (See *Metric Measures*, July 1964, pp. 19-20) it was generally agreed that the Celsius (Centigrade) scale alone should be recognised. For the interim period *i.e.* up to April 1966, manufacturers may, if they so desire, inscribe the Fahrenheit scale in addition to the Celsius (Centigrade) scale on the upper side of the thermometer with the bulb to the left when the thermometer is held in the horizontal position, the Fahrenheit scale being marked only in whole degrees *i.e.* 96°, 97°, 98° F. After April 1966 the provision relating to the Fahrenheit scale would remain withdrawn.

The stem of the thermometer would be graduated from 35°C to 43°C, the subdivisions being at every 0·1°C. In the absence of data on average normal human body temperature in India, the indication for normal temperature would be located at 37·0°C.

Besides the above important details other technical requirements and methods of test of the thermometer were also finalised. It is expected that the standard specification will be printed shortly.

For familiarising the public with equivalents of the two scales, the conversion table given below may be used :

CONVERSION TABLE °C to °F

°C	0	·1	·2	·3	·4	·5	·6	·7	·8	·9
35	95·0	95·2	95·4	95·5	95·7	95·9	96·1	96·3	96·4	96·6
36	96·8	97·0	97·2	97·3	97·5	97·7	97·9	98·1	98·2	98·4
37	98·6	98·8	99·0	99·1	99·3	99·5	99·7	99·9	100·0	100·2
38	100·4	100·6	100·8	100·9	101·1	101·3	101·5	101·7	101·8	102·0
39	102·2	102·4	102·6	102·7	102·9	103·1	103·3	103·5	103·6	103·8
40	104·0	104·2	104·4	104·5	104·7	104·9	105·1	105·3	105·4	105·6
41	105·8	106·0	106·2	106·3	106·5	106·7	106·9	107·1	107·2	107·4
42	107·6	107·8	108·0	108·1	108·3	108·5	108·7	108·9	109·0	109·2
43	109·4									

Alcoholometers

At present the volume of alcohol (ethanol) in an alcohol-water mixture is determined by the use of Sykes' hydrometers and appropriate tables which give the concentration of alcohol in terms of British proof strength. At the time of the change-over to the metric system in the field of alcoholometry, suitable tables were not available. The old tables were, therefore, converted to metric units and used.

The problem of compiling suitable alcoholometric tables was engaging the attention of the Indian Standards Institution (ISI) since about a decade. After consulting international and national authorities, the ISI has now laid down appropriate tables for density, temperature correction, and strength of alcoholic solutions in terms of percentage by volume of ethanol at 15°C etc.

The use of these tables requires that 'centesimal' hydrometers, called alcoholometers, be used.

The Indian Standards Institutions Glassware Committee in its recent meeting approved for wide circulation a draft Indian Standard Specification for Glass Alcoholometers. In this specification two types of alcoholometers have been recognised, Type A and Type B. Type A alcoholometers would be divided into 10° ranges and would have 11 alcoholometers *i.e.* 0-10°, 10-20°,...... 90-100° and 95-105°, graduated at every 0·1°. There will be 4 alcoholometers, in type B, the range being 5° and would read from 0-5, 5-10, 10-15, 15-20° graduated at every 0·2°. The draft specification would be shortly put into wide circulation for comments and would be finalised in the next meeting of the Committee on the basis of comments received.

Autorikshaw Meters

The Indian Standards Institution has already standardized taximeters. It is expected that the printed standard will shortly be made available.

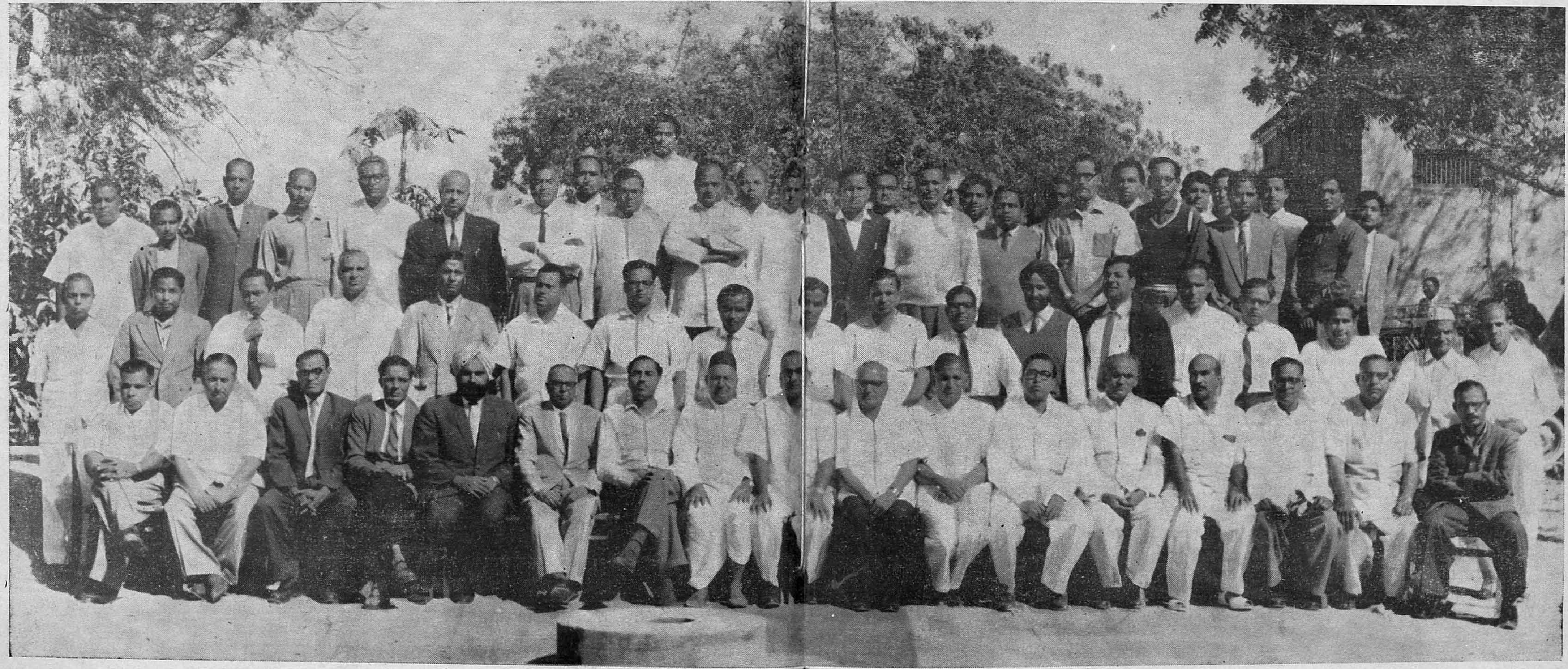
The Taximeter Subcommittee (EDC 41:3) has now taken up standardization of autorikshaw meters.

In many cities autorikshaws are the popular and cheap mode of public transport used by people. In some cities, the rates are arbitrarily fixed by the driver and passenger and arguments ensue. In other cities, the rate is fixed but the reading of distance has to be made on the basis of the odometer and the fare looked up in a table.

In view of the popularity of this vehicle, the need has been felt to provide them with autorikshaw meters which could indicate the fare and avoid disputes and possibility of cheating. The ISI, therefore, took up standardization of suitable meters.

A meeting of the Subcommittee was held in Bangalore on 8 July 1964 to consider this problem. The Subcommittee decided to standardize two types of meters. In one type only the fare for the distance travelled is indicated. The waiting time charges are not indicated on the meter. The second type is a miniature taximeter wherein the distance and detention charges are both added up. The simple fare-meter has been taken up for immediate standardization in order to provide a simple and cheap instrument which the autorikshaw owner can afford. In this meter the total kilometres travelled, the speed indicator and the fare meter are all shown on one dial. The mechanism for calculating detention charges is not included in this meter. A device will also be provided to indicate to the intending traveller whether the autorikshaw

Group Photograph Taken on the Occasion of the Eighth Conference of Controllers of Weights and Measures at Agra, 5-7 March 1964



is for hire or not. The draft standard specification would shortly be put into wide circulation for comments.

Data for standardization of the second type of autorikshaw meters is being gathered and would be processed into a draft specification in due course.

New Plasma Thermometer

A notable forward step in controlled fusion research is the development, at the General Electric Research Laboratory, Schenectady, of a new technique for measuring ultra-high temperatures of the order of millions of degrees. The technique takes advantage of the 'trace' impurities of oxygen and carbon existing in hot deuterium plasmas usually employed in fusion research.

Significant advances have been announced recently by both Russian and American scientists in the realization of highly stable, high-temperature plasmas. The development of the new technique provides the necessary means (a plasma thermometer) of accurate measurement of temperatures in the million degree range which was extremely difficult till now.

To heat the plasma up to ultra-high temperatures, a strong magnetic field in the form of a 'magnetic bottle' is used to compress the plasma. An intense electric discharge is created during this process which then strips some electrons from the 'impurity' atoms of oxygen and carbon. Measurements on the visible and ultraviolet radiations that are emitted as the electrons are torn loose are used to determine the temperature.

This technique has revealed that different types of particles in the plasma are not equally heated. The rapid magnetic compression causes the atomic nuclei to heat much faster than the electrons. Employing this technique it has been found that when the electrons reach a temperature of c. 3 million °C., the nuclei are energized to more than 10 million °C. This phenomenon is highly beneficial as the fusion reactions themselves result from the collisions of atomic nuclei [*Discovery* 24(9) (1963)6; *J. Sci. Industr. Res.* 23 (6) (1964) 264].

South Africa to go Metric?

News reports we have received recently indicate that the possibility of South Africa adopting the metric system is increasing. A Commission is shortly to publish its report on the estimated cost of a change, with its recommendations thereon. It is thought that the recommendation might be in favour of the metric system and if this is so, a Government spokesman has said there are unlikely to be any legal obstacles. (*Monthly Review, April* 1964, p 87).

Book Review

GUIDE TO METRIC SYSTEM IN TIMBER TRADE (English & Gujerati) published by the Bombay Timber Merchants Association Ltd., Victoria Road, Mustafa Bazar, Bombay 10; pp 66; Jan. 1964; Price not given.

The Book contains some valuable tables which are of direct use in day to day commercial transactions in timber trade. The first table gives direct conversions like 1 cm= 0·3937 inch and *vice versa*, or relation of cubic metre to other cubic units etc.

The second table is for direct conversion of inches to centimetres, values ranging from 3/8 in to 24 in, the cm figures being rounded off to the nearest cm after 1 in. The third table is for conversion of stock sizes of sawn timber. The existing inch sizes have been converted according to Table 2 to metric dimensions and volumes indicated in cubic decimetres for lengths of 10, 5, and 1 metre and 10 cm and 5 cm. The inch sizes range from $1'' \times \frac{1}{2}''$ to $18'' \times 18''$. The dm^3 figures are given to 3 places of decimals. The next table gives conversion of prices from the cubic foot to 10 cubic decimetres by steps of 25 P, from Re. 1 to Rs. 38 per cu. ft. A table showing conversion of prices from 1 ton to 1 cubic metre is also included, the range being Rs. 100 to Rs. 1000, in steps to Rs. 5.

A useful table showing 'new' sizes of timber in cm, and giving corresponding volume in dm^3 for lengths of 10m, 5 m, 1 m and 10 cm is also included. This table covers such items as battens and packing planks, reepers, scantlings, planks, flitches, posts, beams etc. The final table shows the comparative suitability of Indian timbers expressed as percentages of teak with relevant particulars.

Informative introductory notes explaining how the tables should be used are given for every table. These facilitate comprehension of the proper use of the new system.

The Government of India has recommended that the cubic metre should be used for pricing and other connected work. The use of 1/10 or 1/100 of the cubic metre as a unit was discouraged. These tables contain, however, a table indicating conversion of prices per cubic foot to 10 cubic decimetres *i.e.* 1/100 cubic metre. In view of the Government of India's recommendation, it is to be hoped that this particular table would be replaced by a new one. When we adopt the metric system, we should adopt it with all its implications. The use of fractions of the cubic metre as pricing units should be avoided if the adoption of the metric system in the timber trade is to be meaningful.

In other respects, this book is a mine of information and would be useful to those engaged in the timber trade.

VOLUME TABLES FOR ROUND OR SQUARED TIMBER UNDER METRIC SYSTEM (Part II)—Compiled by T. Janaky; Published by Bharathee Bhooshanam Press, Viyyur (P.O.), Trichur, Kerala; pp 321-661; March, 1964; Price Rs. 8.00.

This is Part II of the excellent volume compiled by Shri Janaky. Part I was reviewed in *Metric Measures*, Vol. 7, No. 2, p 31.

Part II carries forward the tables given in Part I. In this Part, girths from 181 cm to 500 cm have been covered. The pattern of presentation is the same as in Part I. The lengths are given in steps of 5 cm from 5 cm to 15 metres for each girth up to 200 cm. After that the tables go up to a length of 7·50 metres.

It is to be hoped that in the second edition, minor errors like use of wrong abbreviations *e.g.* c. ms. for cm etc. would be avoided. Otherwise, the presentation is handy and useful.

The volume tables have been approved for use of the Kerala Forest Department. There is no doubt that the tables are useful. Other States may also examine them for adoption.

THE TABLE OF THE AREA OF CIRCLES IN LITRES First Part (From 2.5 cm to 500 cm); Prepared and published by Sri U.C. Sarmah, Tinsukia, Assam; 1962; pp 25; Price Rs. 1.75.

The change-over to the metric system in the alcohol industry is complicated because in many cases the very basis of calculations has to be altered completely. It has also a financial aspect for the State as when gauging is required for excise purposes. The old tables cannot be used as they are based on the inch and the gallon. New tables have to be prepared. One such field is the recalibration of vats and tanks in distilleries and spirit warehouses. New tables had to be prepared based on the centimetre and the litre.

Shri U.C. Sarmah, Retired Excise Assistant of the Tinsukia Spirit Warehouse, Assam and Government Authorized Tank and Vat Calibrator, has brought his 30 years' experience to bear on the preparation of useful data for the Excise Department. This book gives the areas of circles in litres of one centimetre depth of a circular base. The assumption is that the vat is a perfect cylinder. The volume of one centimetre depth for a given diameter is then :

$$\frac{0{\cdot}7854 \times \textit{diameter (cm)} \times \textit{diameter (cm)}}{1000{\cdot}028} = \text{litres.}$$

The present tables in Part 1 range from 2·5 cm to 500 cm, by steps of one millimetre. It is obvious that the compiler has taken great pains to put together some 5,000 values, check and recheck them. Values have been given in litres to 4 places of decimals so that rounding off can be carried out by the user according to practice.

The second part, to be published shortly, will cover the range from 501 cm to 1000 cm.

There can be no doubt that Shri Sarmah has done a great service to the alcohol industry in its change-over. It is hoped that his service will be adequately utilized by the industry and others concerned

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CORRECTIONS

Please note the following corrections in the July 1964 issue.

(1) On p 20, in place of the present item (1) New Industrial Enterprises, read as follows :
'Promoters of new industrial enterprises are advised to have the products and, to the extent possible, the machinery installed, designed on the metric system.

(2) p 22, abbreviation for micro is μ, and for micron μm. For हैक्टो read हेक्टो.

(3) p 23, for डैसिमीटर and हैक्टोमीटर, read डेसिमीटर and हेक्टोमीटर. Insert cubic hectometre, hm^3, घन हेक्टोमीटर, हेमी^{3}, घन हेमी.

(4) p 24, for (microgram) Mg read μg

(5) p 25, for 1 July 1960, in caption of first paragraph, read 1 July 1964.

(Indian Standards which have a particular bearing on the change-over to the metric system are indicated here. Copies would be available from the Indian Standards Institution, Manak Bhawan, 9, Bahadur Shah Zafar Marg, New Delhi or their Branch Offices at Bombay, Calcutta, Kanpur and Madras.)

Hot-Rolled Mild Steel Strip for Cold-Reduced Tin plate (Draft).

Indian Standards Institution has prepared *draft* Indian Standard Specification for Hot-Rolled Mild Steel Strip for Cold-Reduced Tinplate [Doc: SMDC 5(416)], which covers the requirements for three grades of hot-rolled mild steel strip, namely (a) Deep drawing, (*b*) Ordinary temper, and (*c*) High temper.

The draft standard will be circulated shortly to those interested for technical comments.

Dimensions of Tables for General Office Purposes (Draft).

Indian Standards Institution has prepared *draft* Indian Standard Specification for Dimensions of Tables for General Office Purposes [Doc: BDC 35(437)], which covers the dimensions of tables for general office purposes.

The need for this standard has been felt for quite some time in relation to various sizes of furniture particularly office tables to be ordered by various Government Departments. The table top sizes have been specified taking into consideration the relevant standards on plywood, blockboards, hard boards, steel and aluminium sheet specifications. In sofar as the office tables are concerned, the proposal is restricted only to single pedestal type on the left hand side of the seat (though the sizes specified may permit two pedestals). Special large size tables have not been included in this. It is strongly suggested that no knee hole drawer be specified at all, since it is not convenient.

The knee space dimensions are based on chair dimensions assuming a height of 430 mm, the minimum width of seat of 400 mm measured at the point midway along with the depth of the seat. The Committee is actively considering the question of relating the dimensions of furniture to the anthropometric requirements of the Indian people in general. For this, data are now being collected. In the meantime, the dimensions, particularly in plan for table tops are related to the module of 10 cm.

The draft standard will be circulated shortly to all interests concerned for eliciting technical comments.

Heavy Cee Jute Bags and Jute Corn Sacks (Draft)

Indian Standards Institution has prepared two *draft* Indian Standard Specifications for :

(*i*) Heavy Cee Jute Bags [Doc: TDC 41 (765)], and

(*ii*) Jute Corn Sacks [Doc: TDC 41(766)].

Doc: TDC 41(765) prescribes the requirements for heavy cee jute bags of dimensions 102×71 cm (or 40×28 in).

Doc: TDC 41(766) prescribes the requirements for jute corn sacks (or jute corn bags) of dimensions 104×58 cm (or 41×23 in).

These draft standards are being circulated for eliciting technical comments.

Commercial Metric Weights (Draft)

The Indian Standards Institution has prepared *draft* Indian Standard Specification for Commercial Metric Weights [Doc: EDC 41 (923); Revision of IS: 1056-1957].

IS:1056, which was first published in 1957, prescribes the requirements for metric solid and sheet metal weights intended for use in normal commercial transactions. It does not cover proportional weights that are used, for instance, in certain types of weighing machines, weighbridges etc.

Main modifications made in the present revision are as follows:

(*a*) In order to conserve strategic imported material such as copper, zinc, tin, etc. non-bullion flat cylindrical weights have been eliminated;

(*b*) 50 g and 20 g cast iron and mild steel weights have been recognised; and

(*c*) Dimensions of weights have been revised in many instances.

The draft standard will be circulated shortly for eliciting technical comments.

Hard Drawn Carbon Steel Wire for Spring for General Engineering Purposes

The Indian Standards Institution has published the first revision of Indian Standard Specification for Hard Drawn Carbon Steel Wire for Spring for General Engineering Purposes (IS:727—1964), which lays down the requirements for hard drawn carbon steel wire for springs for general engineering purposes.

This standard was first issued in 1955. Based on the experience gained in the use of this standard during the last nine years, the Sectional Committee decided to revise this standard.

In this revision, besides metricization, the tensile properties and chemical composition have been brought in line with IS:1570—1961 Schedules for Wrought Steels for General Engineering Purposes.

Price Rs. 2.00

Withdrawal of IS:1138—1958 Sizes of Metal Strip, Sheet, Bars (Round and Square), Flats and Plate (For Structural and General Engineering Purposes)

It has been decided to withdraw IS: 1138—1958 Sizes of Metal Strip, Sheet, Bars (Round and Square), Flats and Plate (for structural and General Engineering Purposes) as separate standards for sizes of steel products, copper and copper alloy products, and aluminium and aluminium alloy products have been taken up for formulation.

The sizes of steel products have already been *finalized and published.* Dimensional standards for aluminium and aluminium alloy products have been finalized and are under print, while the dimensional standards for copper and copper alloy products have recently been finalized by the Copper and Copper Alloys Section Committee, SMDC 11.

Licensed Manufacturers and Repairers

(*Metric Measure* had been publishing in the past a series of lists of licensed manufacturers, dealers and repairers of weights and measures, weighing and measuring instruments licensed by the Governments in the various States and Union Territories under their Weights and Measures (Enforcement) Acts. To economise on paper, it is possible only to publish lists of licensed manufacturers and repairers.

A feature on statistics of verification and licences issued is also being published in *Metric Measures.*)

STATISTICS OF VERIFICATION OF WEIGHTS ETC., AND LICENCES

States/Union Territories	Period	Weights	Capacity Measures	Length Measures	Weighing Instruments	Measuring Instruments	Others	Total number of: Mfrs.	Dealers	Repairers
(1) Andhra Pradesh	1 Feb. 64 to 31 May 64	2,00,101	64,362	6,408	21,747	527	26	14	59	24
(2) Assam ..	1 Feb. 64 to 31 May 64	1,60,587	31,022	1,480	3,345	50	—	18	248	129
(3) Bihar ..	1 April 62 to 31 Jan. 63	1,28,211	—	—	19,309	56	—	30	203	43
(4) Gujarat ..	1 Dec. 63 to 31 June 64	1,97,859	20,966	2,390	30,175	148	—	2	6	5
(5) Kerala ..	1 April 62 to 31 July 62	—	—	—	—	—	—	73	459	142
(6) Jammu & Kashmir	1 April 63 to 31 March 64	2,12,854	2,582	7,511	683	..3	4	36	36	2
(7) Madhya Pradesh	1 April 62 to 30 Nov. 63	12,76,615	2,15,103	16,837	41,920	457	—	60	462	46
(8) Madras ..	NA	—	—	—	—	—	—	—	—	—
(9) Maharashtra	1 April 62 to 31 March 63	1,874,286	5,37,135	33,988	—	—	—	—	—	—
(10) Mysore ..	1 April 62 to 31 Nov. 62	4,81,345	1,05,253	1,089	1,596	2	—	8	103	6
(11) Punjab ..	1 Feb. 64 to 31 March 64	1,18,584	5,732	4,121	14,993	127	—	—	4	3

States/Union Territories	Period	Weights	Capacity Measures	Length Measures	Weighing Instruments	Measuring Instruments	Others	Total ncmber of Mfrs.	Dealers	Repairers
(12) Orissa ..	Jan. 63 to May 64	1,97,851	30,025	1,055	4,891	77	—	8	103	6
(13) Rajasthan	N.A.	—	—	—	—	—	—	—	—	—
(14) Uttar Pradesh	1 June 63 to 30 Nov. 63	8,95,335	8,897	20,506	7,505	278	—	200	979	187
(15) West Bengal	1 May 64 to 4 July 64	1,47,955	12,077	757	19,229	—	—	—	—	—
(16) Andaman & Nicobar Islands.	N.A.	—	—	—	—	—	—	—	—	—
(17) Delhi ..	1 Dec. 63 to 31 May 64	1,24,031	9,021	1,984	15,924	172		66	26	71
(18) Goa	1 April 64 to 31 May 64	13,523	1,012	23	26	—	—	—	353	—
(19) Himachal Pradesh	1 April 62 to 31 July 63	68,020	7,411	2,532	10,628	1	—	1	25	12
(20) L.M.A. Islands	N.A.	—	—	—	—	—	—	—	—	—
(21) Manipur ..	1 April 64 to 31 May 64	1,660	54	—	135	3 (Tanklorry)	—	—	—	—
(22) Pondicherry	1 Feb. 64 to 31 March 64	4,038	1,341	36	21	4	37 (Peg measures)	4	10	3
(23) Tripura ..	1 April 62 to 30 July 62	62,050	8,464	720	9	8	—	4	85	3

N.A.—Statistics not available as yet.

KERALA

Manufacturers and Repairers licensed from 1.4.1964 to 30.6.1964

MANUFACTURERS

Sl. No.	Name and Address of Manufacturers	Details of Articles Manufactured
(1)	Ashoka Foundry & Engineering Works, Pappanam Code, Trivandrum.	Cast Iron Weights.
(2)	Chathurthy Metal Industries, Mulanthuruthy, Ernakulam	Beam Scales Class C. & D.
(3)	H.S.M.A. Kader, H.J.T. Industries, T.C. 37/712, Valyasala, Trivandrum.	Beam Scales Class C. & D.
(4)	M. V. Kunjan, Mangalathu House, Thalacode Post, Trippunithena, Ernakulam.	Beam Scales Class C. & D.
(5)	P. B. Natarajan Chettiar, Setra Industries, Multan Bazar, Shertalai, Alleppey.	Beam Scales Class C. & D.

Sl. No.	Name and Address of Manufacturers	Details of Articles Manufactured
(6)	K. M. Ponnappanasary, Lakshmi House, South Aryad, Ashramam-ward, Alleppey.	Beam Scales Class C. & D.
(7)	Rafia Industries, Prof. Shri A. F. Meeran, Karnmkara, M.M.C. IV 96, Murattupuzha, Ernakulam.	Beam Scales Class C. & D.
(8)	Three Kings Metal Industries, Anchalpetty P.O., Via, Murattupuzha.	Beam Scales Class C. & D.
(9)	S. Velayudhan Achary, Pullathottathu Thekkathil Veedu, Punnathala, Quilon.	Beam Scales Class C. & D.

Repairers

(1) K. Anandan, Valathuthekethil Veedu, Pannivizha, Adoor.

(2) K. Damodaran, Kambiakathu Veedu, Mararikulam, N. Kanjikuzhi, S. L. Puram P.O.

(3) M. I. John, C/o K.V. Mathew & co., Govt. Wiring Contractors, and Engg. K.K. Road, Kottyam.

(4) K. P. Kani Rowther, Tin Manufacturing Co., Athirampuzha.

(5) Musaliar Industries (P) Ltd., Quilon-4

(6) Panoli Aydross, S/o Alavi Tin Maker, Eastern Road, Manjeri.

(7) P. Padmanabhan Achari, Lakshmivilasom, T.C. 983, Manacaud, Trivandrum.

(8) The Southern Scale Services, Kozhikode.

(9) B. Subramaniam, Proprietor, Sree Murugare Scale Service, Vegetable Market, Kottyam.

(10) Veliyam Parambil Cheeku Onseph, Methala Village, Cranganoor.

WEST BENGAL

Manufacturers

Sl. No.	Name and Address of Manufacturer	Details of Articles Manufactured
(1)	Avery Co. of India Private Ltd., 28/2, Waterloo Street, Calcutta	Beam Scale Weighing Machine, CI. and Brass Weights.
(2)	Asiatic Machinery Corpn. (P) Ltd., 10/1, Kailaschandra Lane P.O. Santragachi, Howrah.	All types of Weighing Instruments
(3)	Balai Engineering Works, 82, Prem Chandra Bara St., Calcutta-12	Metallic Linear Measures.
(4)	Balai Chandra Das, 54/1/H/3, Sura East Rd., Calcutta-10	Beam Scales.
(5)	Banka Behari Laha, Bahabazar, Rajiganj, Burdwan, Asansol ..	Beam Scale (Class C&D)
(6)	Barangar Mechanical Industries, 295, Maharaja Nanda Kumar Road, Baranagar, Calcutta.	Brass Beam Scale, Brass Weights (Bullion & Non-Bullion Sheet Metal Weights)
(7)	Bag & Co. 239, Duttabad, Calcutta-48 (Barrackpore)	Beam Scale.
(8)	Bharati Scales & Engineering Co 4/1, Halder Para Lane, Howrah	C.I. Weights, Weighing Instruments and Beam Scales.
(9)	Bhagyadevi Factory, (Foundry Division) Shanpur, Dassnagar, Howrah.	C.I. Weights.
(10)	Balai Engineering Works, Prop. Sri Balai Talikdar, 82, Prem Chand Boral Street, Calcutta-12.	Metallic Linear Meassures.

Manufacturers—(contd.)

Sl. No.	Name and Address of Manufacturers	Details of Articles Manufactured
(11)	Bengal Chemical & Pharmaceutical Works, 164, Manicktala Main Road, Calcutta-11.	Precision Balance Metallic Volume Measures & Beam Scales (Class A&D).
(12)	Bharat Weighing Scales & Engineering, 75, Mala Chand Nandy Lane, Howrah.	All types of weighing Instruments including Beam Scales.
(13)	Bengal Steel Industries, 6, Kumarpara Road, Lilooah	Cast Iron Weights.
(14)	Calcutta Balance & Weight Works, 197, Maharaja Nanda Kumar Road (South), Calcutta-36 (Barrackpore).	Beam Scales & Brass Weights, (Bullion & Non-Bullion Sheet Metal Weights).
(15)	Diamond Metallic Tape Co., 385, Beeharam Chatterjee Road, Behala, Calcutta-34.	Woven Metallic Tapes, Steel Tapes and Wooden Scales.
(16)	Durga Galvanised Works, 7, Raja Naba Kissen St., Calcutta-5 ..	Capacity Measures.
(17)	Dinesh Chandra Karmakar, 74/4 Charak Danda Road, Calcutta-10	Beam Scales.
(18)	Dutson Engineering Corporation Private Ltd., 5, Mahendra Chandra Dutta Garden Road, Dum Dum, Calcutta-30.	C.I. Weights, Brass Weights, Weighing Instruments and Litre Measures.
(19)	M. C. Das & Bros., 10/18, Brindaban Mullick Lane, Howrah ..	All types of weighing instruments.
(20)	Dhirendra Nath Ghosh, 4, Hem Dey Lane, Calcutta-50	Beam Scales.
(21)	Dhirendra Metal Works, 7/1 Beneras Road, Howrah	Capacity Measures.
(22)	H. P. Das & Co., 22, Sree Gopal Mullick Road, Ariadah, 24 Parganas.	Beam Scales, Bullion and Non-Bullion Brass Weights.
(23)	D. C. Dey & Sons, 150, Narasingha Dutta Road, Howrah ..	Cast Iron Weights.
(24)	Durga Galvanised Works, 7, Raja Naba Krishna Street, Calcutta-5	Cast Iron Weights.
(25)	Dragon Iron Works, 31, Kissenlal Burman Road, Salkia, Howrah	Cast Iron Weights.
(26)	East Indian Engineering & Agency Co. 63/1 Beneras Road, North Bantra, Howrah.	C.I. Weights.
(27)	East India Metal Co. Private Ltd., 41/1B, Ram Kanta Bose Street, Calcutta-3.	C.I. Weights.
(28)	Education Emporium, 188/77, Prince Anwar Shah Road, Calcutta-31.	Precision Balance and Weights for Laboratory purposes.
(29)	Electro Gas Welding Co., Panihati, B. T. Road, 24 Parganas, (Barrackpore).	Beam Scales.
(30)	Eastern Weighing Machine Co., 89, Kasundia Road, Howrah ..	Counter Machine.
(31)	Eastern Scales Private Ltd., 12, Gurusadya Road, Calcutta-19 ..	Beam Scales, Class A & B and Brass Weights.
(32)	Economic Scientific Works, 97, A. Sree Ram Dhaug Road, Salkia, Howrah.	Beam Scales Class A & B and Brass Weights.
(33)	Free India Scales Corporation, 76/1, Beneras Road, Howrah ..	Weighing Instruments.
(34)	P. C. Ghosh & Sons, 21, Brindaban Mullick Lane, Howrah ..	C.I. Weights.
(35)	Girish Chandra Ghosh, 37, B.T. Road, Calcutta	Beam Scales, Counter Scales, Brass Weights, Bullion Weight, Litre and Linear Measures.

Manufacturers—(contd.)

Sl. No.	Name and Address of Manufacturers	Details of Articles Manufactured
(36)	A. C. Ghosh, 114, Makardah Road, Howrah	C.I. Weights.
(37)	General Metal Industries, 185/1A, Bepin Behari Ganguly Street, Calcutta-12.	Capacity Measures.
(38)	Gopal Chandra Das, 98/H/B, Charakdanga Road, Calcutta-10 ..	Beam Scales.
(39)	Great Eastern Machine, House Private Ltd., Dassnagar, P. 85, Beneras Road, Belgachia, Howrah.	C.I. Weights.
(40)	D. Ghosh & Co., 36, Bholanath Nath St., Calcutta-36 (B. K. Pore).	Beam Scales Class C & D.
(41)	Gopal Chandra Karmakar & Sons, 16/B, Tarak Bose Lane, Calcutta-2.	Beam Scales only.
(42)	Gopal Chandra Karmakar & Co., 16/C, Tarak Bose Lane, Calcutta-2.	Beam Scale.
(43)	Girish Chandra Ghosh, 37, B.T. Road, Calcutta-2	Beam Scales, Counter Scales, Brass Weights.
(44)	Ganga Iron & Galvanizing Works P. Ltd., 94, 'O' Road, Belgachia, Dassnagar, Howrah.	Cast Iron Weights.
(45)	A. C. Ghosh, 114, Makardah Road, Howrah	Cast Iron Weights.
(46)	A. K. Ghosh, 9, Natabar Paul Road, Kadamtala, Howrah	Non-Bullion Brass Weights.
(47)	India Scale Co., 74, Diamond Harbour Road, Calcutta	Beam Scales, Class C. & D.
(48)	Indian Machinery Co. Ltd., Dassnagar, Howrah	All Kinds of Weighing Instruments including Beam Scales, Cast Iron and Brass weights.
(49)	B. N. Industrial Corporation, 16, Motilal Gupta Road, Calcutta-8	Brass Weights.
(50)	Howrah Engineering & Galvanizing Works, 68, Beneras Road, Howrah.	C.I. Weights.
(51)	Jeewanlal (1929) Ltd., 95, G.T. Road, Belur, Howrah	All types of Litre measures.
(52)	Jewel Engineering Works, 10, Lower Chitpur Road, Calcutta-1 ..	Persons Weighing Scale.
(53)	James Scales & Engineering Co., 54/1/1 Kasundia Road, Howrah	Platform Machines.
(54)	Karmakar & Co., 76, D.H. Road, Barisha, Calcutta-8 (24 Pargs.) ..	Beam Scales, Class C & D.
(55)	Kali Iron Foundry, Shanpur, Makardah Road, Howrah	C.I. Weights.
(56)	Martick Chandra Das, 4/B, Jackson Lane, Calcutta-10	Litre Measures.
(57)	Karmakar & Co., 5, Sashi Bhuson Banerjee Road, Rarisha, Calcutta-8 (24 Pargs.)	Beam Scales, Class (C & D)
(58)	Kundu Sett & Co., 16, Ram Charan Sett Road, Ram Rajatola, P. O. Santragachi, Howrah.	C.I. Weights.
(59)	Kusheri & Co., 71/a, Dharmatala Street, P.O. Ghusuri, Howrah ..	Brass & Bronze Weights (Both Bullion & Non-Bullion).
(60)	R. K. Karmarkar & Sons, P.O. Mahula, Murshidabad	Beam Scales.
(61)	Kollay Engineering Works, Ichapur Road, Dassnagar, Howrah ..	Beam Scales (Class C & D.)
(62)	Krishna Iron and Steel Enterprises, 29 & 38 Chawk Para Road, Lilooah, Howrah.	Cast Iron Weights.
(63)	Kumar & Co., Prop. Sri S. Kumar, 11, Broad Street, Calcutta-19.	Conical Measures.

Manufacturers—(contd.)

Sl. No.	Name and address of Manufacturers	Details of Articles Manufactured
(64)	Krishna (P) Ltd., 39, G.T. Road, Lillooah, Howrah	Cast Iron Weights.
(65)	Laxmi Narayan Scale Industries, 26, Ratan Babu Road Calcutta-2	Metre, Litre and Beam Scales.
(66)	Luxmi Scale Works, 41, Chandi Charan Banerjee, Lane, Calcutta-35.	Brass Weights, Beam Scales and Counter Scales.
(67)	Lakshmi Foundry Works Private Ltd., 67, Beneras Road, Howrah	C.I. Weights.
(68)	Lilooah Iron Works, 6, Gaha Park, Lilooah, Howrah	Cast Iron Brass Weights
(69)	Laha Lalabazar, Bankura Town, Bankura (S)	Beam Scales.
(70)	Metric Scale Manufacturers and Repairers, P.O. Kolaghat, Puratan Bazar, Midnapore (Tamluk).	Beam Scales.
(71)	Monoranjan Karmakar, P.O. Nowbhanga, P.S. Bhangore, 24-Parganas.	Beam Scales Class C. & D.
(72)	Matiari Karmakar Samabay Samity Ltd., Vill. Maliari, P.O. Dhuturdah, 24-Parganas. (Basirhat).	Beam Scales, (C. & D.).
(73)	Majedar Rahman Molla & Son, P.O. Galsi, G.T. Road, Burdwan (S).	C.I. Weights.
(74)	Mahip Ram Shaw, 31/2, Kali Banerjee Lane, Howrah	Non-Bullion Brass Weights.
(75)	Naba Kumar Routh, P-33, Beneras Road, (2) 50/1, Fakirbagan Lane, Howrah.	C.I. Weights, Metallic Commercial Length Measures, Capacity Measures & (Dipping and Pouring.)
(76)	Nandi Keswari Iron Foundry Private Ltd., 10K Road, Belgachia, Howrah, Dassnagar.	C.I. Weights.
(77)	Nagendra Nath Karmakar, C/o Wooma Charan Karmakar, 16 & 17, Narikeldanga Main Road, Calcutta-11.	Beam Scale & Counter Scale.
(78)	Naresh Chandra Karmakar, 426, Jessore Road, Pantipukur, Barrackpore, 24-Parganas.	Beam Scales.
(79)	Nil Kanta Ray, 13/1 Radha Madhab Dutta Garden Lane, Calcutta-10.	Iron Beam Scale (C. & D.)
(80)	S. K. Nath, 8, Ratan Babu Road, Calcutta-2	Bullion Weights, Counter Scales, Brass Beam Scale, Brass Weights Non-Bullion Sheet metal weights (Bullion & Non Bullion).
(81)	Ram Raja Galvanizing Works, Ram Charan Sett Road, Ram Rajatola, Howrah.	Capacity Measures
(82)	Ram Kumar Agarwala, 88/A, Madan Mohan Barman St., Calcutta-7	Metallic Linear Measures.
(83)	Rohtak Weighing Machine & Engineering Co., 134/11, Kasundia, Howrah.	Counter Scales.
(84)	Progressive Engineering Co., Duttabad, Calcutta-48, Barrackpore ..	Iron Beam Scales, Class C. & D.
(85)	Poddar Iron Industries, V. Road, P.O. Dassnagar, Howrah ..	Cast Iron Weights.
(86)	Pioneer Engineering Scale Co. Cast Iron Ananda Karan Baltikuri, Howrah.	Cast Iron Weights.

Manufacturers (concld.)

Sl. No.	Name and Address of Manufacturers	Details of Articles Manufact ured
(87)	Roy Engineering Works, 220, Netaji Subhas Road, Howrah	Brass Weights (Non-Bullion)
(88)	W. B. Scales Co. Private Ltd., 10, Kailash Chandra Lane, Santragachi, Howrah.	All types of Weighing Instruments including Beam Scales and C.I. Wts.
(89)	Satish Chandra Das & Sons., 23/1, 25A, Ratan Babu Road, Calcutta-2	Brass and Steel Metal Weights, Beam Scales and Counter Scales.
(90)	Sasanta Kumar Paul, 80, Institute Lane, Calcutta-36 (Barrackpore)	Brass Weights, Bullion & Non-Bullion Sheet Metal Weights (Bullion & Non-Bullion).
(91)	K. C. Samanta & Co., 19, Atul Krishna Bose Lane, Calcutta-36 (B. K. Pore).	Counter Balance Beam Scale Brass Weights (Bullion) Steel Metal Weights, (Bullion and Non-Bullion), Length Measure and Iron & Steel Weights.
(92)	Santosh Kumar Mandal, 13/11, Radha Madhab Dutta Garden (Small) Lane, Calcutta-10	Iron Beam Scales (Small).
(93)	B. K. Shaw Industries (P) Ltd., 10, Jessore Road, Calcutta-28 (Barrackpore), 24-Parganas.	Dispensing Measures.
(94)	Sankar Engineering Co., Prop. Sri Kamal Das, Sri A. P. Roy, Shri Amat Bose, 16A, Haldarpara Lane, Howrah.	Brass Weights & Beam Scales.
(95)	Tarak Nath Paul, 20, Abinash Sashmal Lane, Calcutta-10	Beam Scale, Class C. & D. (1 kg., 2 kg., 5 kg.).
(96)	Tulsi Charan Karmakar, 92, Diamond Harbour Road, Barisa, 24-Parganas.	Beam Scales.
(97)	Wooma Charan Karmakar, C/o Barindra Lal Karmakar, 22D/23A, Narikeldanga Main Road, Calcutta-11.	Beam Scales & Counter Scales.
(98)	Wooma Charan Karmakar, Dwijendra Lal Karmakar, 22D, 23A, Narikeldanga Main Road, Calcutta-11.	Beam Scales.
(99)	Wooma Charan Karmakar, 22D, 23A, Narikeldanga Main Road, Calcutta-11.	Weighing instruments including Beam Scales, Brass Weights (Non-Bullion).
(100)	Wooma Charan Karmakar, C/o Jogendra Nath Karmakar, 23/C, Narikeldanga Main Road, Calcutta-11.	Beam Scale.
(101)	Wooma Charan Karmakar, C/o Balai Chandra & Others, 23/B, Narikeldanga Main Road, Calcutta-11	Beam Scale (C. & D.) Vibrating type Counter Scale Brass Weight Bullion and Non-Bullion) and C.I. Weights.

CORRECTION

On page 19 of Vol 7, January 1964, *Metric Measures* under "How to use the Tables" second line, *read* "girth 175 cm."

M67DPD/64—GIPF.

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—*Jawaharlal Nehru*

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TYPICAL METRIC PRICING UNITS FOR WHOLESALE TRANSACTIONS

Serial No.	Commodity	Metric Unit
(1)	**Gold**	10 grams (g)
(2)	**Grocery and Confectionery** Biscuits, sweetmeats, cardamoms.	1 kilogram (kg)
	Textiles and Textile Fibres Cotton yarn, damaged and seconds cloth, raw silk, rayon silk yarn, raw wool, wool manufactures (when sold by weight).	
	Paints & Chemicals Paint (if sold by weight), indigo, liquid chlorine.	
	Hides, Skins & Leather Raw hides, leather (hides and skins).	
	Metals Silver, aluminium sheets, strips and circles, copper and brass wires and utensils.	
	Miscellaneous Tea, meat, camphor tablets, mica.	1 quintal (q) (100 kilograms)
(3)	**Grains and Pulses** Rice, wheat, jowar, arhar, moong, masur, gram.	
	Spices Black pepper, mustard, chillies, dhania, dalchini, turmeric, betelnuts.	
	Plantation Products Rubber, cashewnuts, cashew kernels, tobacco (raw and manufactured).	
	Forest Products Lac and lac products, gums, myrobalans, galnuts, soapnuts.	
	Textiles & Textile Fibres Raw jute, raw hemp, coir yarn.	
	Oils, Oilseeds & Oilcakes Vegetable oil, oilseeds, oilcakes.	
	Non-Ferrous Metals *Aluminium :* ingots, bars, blocks, slabs, billets. *Lead :* ingots, sheets and strips. *Copper :* ingots, blooms, slabs, cakes, tiles, bricks, billets, blisterbars and wirebars, rods, sections and pipes, plates, sheets and strips, circles. *Brass :* ingots, rods, sections, pipes, sheets, strips, circles. *Zinc :* ingots, sheets, strips. *Tin :* blocks.	
	Chemicals Caustic soda, bleaching powder, glycerine, soaps, paper salt.	
	Others Sugar, gur, ice, fish, sugarcane, vegetables, tamarind.	one metric tonne (t) (1,000 kilograms)
(4)	**Minerals** Iron ore, manganese ore, bauxite, coal.	
	Iron & Steel Pig iron, iron & steel manufactures, semis (billets for rerolling etc.)	
(5)	Cloth (mill, handloom, silk rayon and woollen cloth)	1 metre (m)
(6)	Jute carpets, coir mats and mattings, sheet glass.	one square metre (m^2)
(7)	Timber.	one cubic metre (m^3)
(8)	Paints (when sold by measure), spirits.	one litre (l)

Weights

(1) In place of the present units of seer, pound, rattal, viss etc., use the kilogram.

(2) In place of the tola, use the gram or 10 grams.

(3) In place of maund or corresponding unit, use the quintal *i. e.*, 100 kg.

Capacity Measures

In place of seer or gallon or any other measure, use the litre.

Length Measures

(1) Use the metre in place of yard or foot and the centimetre in place of inch.

Square Measures

(1) Use the square metre in place of square yard or square foot, and square centimetre in place of square inch.

Cubic Measures

(1) Use the cubic metre in place of cubic yard or cubic foot and cubic centimetre in place of cubic inch.

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Serial No.	Commodity	Metric Unit for Use
(1)	Foodgrains, cereals, pulses, spices, ghee, bread, vegetables, meat, fish, sweetmeats, tea, coffee, sugar, salt.	1 kg
(2)	Oil for cooking	1 kg or 1 litre depending upon prevalent practice.
(3)	Fruits	1 kg or number depending upon prevalent practice.
(4)	Milk	1 litre
(5)	Cloth and related materials	1 metre
(6)	Prepackaged materials	Preferably sizes corresponding to series of commercial weights and measures.

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